Two New Zealand Timbers

will meet your needs

NEW ZEALAND FOREST SERVICE

Information Series No. 34

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Front cover illustration: Maoris at work on a building foundation. *Photo: National Publicity Studios.*

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This brochure was prepared by

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N.Z. Forest Service, Wellington

1961

NEW ZEALAND FOREST SERVICE

FORESTS IN PERPETUITY

Radiata pine (*Pinus radiata*) and Douglas fir (*Pseudotsuga taxifolia*), which form a substantial part of New Zealand's million acres of conifer forests, are not only meeting much of New Zealand's timber needs but are also being exported. These large areas of merchantable forests are being further extended to provide increasing quantities of raw material for saw timber, roundwood, and other wood products, including pulp and paper for local and overseas markets.

Today radiata pine is New Zealand's principal construction timber, and an all-purpose utility timber for packaging, etc.; it is much used as a decorative wood for the manufacture of wall panelling and furniture, and is the source of an expanding pulp and paper industry.

This wide range of uses can be attributed to its remarkable inherent properties and to an understanding of those properties and of the timber's limitations. Careful grading – together with the application of modern processing, seasoning, preservative treatment, and merchandising techniques – has taken full advantage of the timber's properties.

For strength in construction Douglas fir has already established a high reputation. Moreover, the sawn timber coming even from logs of relatively small diameter is notable for its heartwood content. Logs which are too small for sawing are very suitable for use as natural round poles and posts after treatment with creosote, or for mine props, rails, and rustic work.

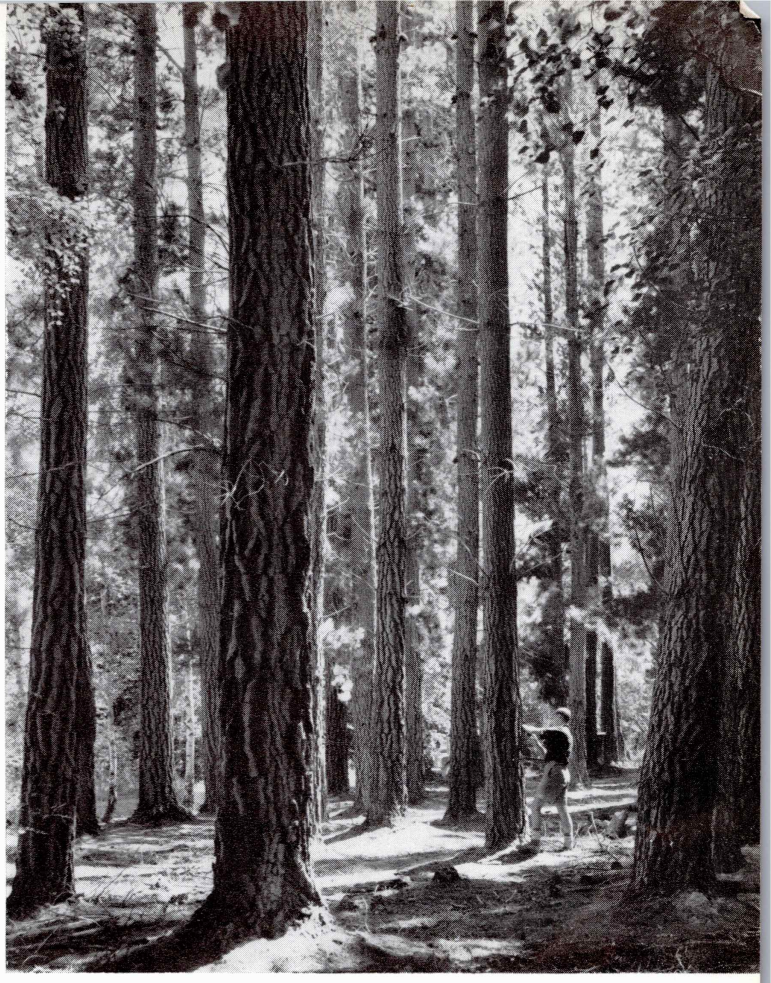
Larch (*Larix decidua*), which is also grown in New Zealand, has characteristics and uses similar to Douglas fir and is therefore, sometimes marketed with Douglas fir.

Part of Kaingaroa forest showing compartments, loading squares and access roads for thinning operations

THE TREES

Radiata pine, confined mainly in its natural state to a limited area of the Monterey Peninsula of California, has been truly remarkable for its successful introduction into New Zealand and its widespread use for afforestation. It is now the most important commercial tree in New Zealand, having been planted extensively in all settled districts for shade, shelter, fuel, and timber – in State forests and in large commercial plantations.

Characteristically the tree produces whorls of branches, indicating the yearly increase in height, which frequently exceeds 4 ft and may be as much as 7 ft. This pattern of growth is important when the sawn product is considered as a source of defect-free lengths of timber.



Radiata pine at Hanmer Forest, North Canterbury, New Zealand

Douglas fir, commonly known as Oregon or Oregon pine, was introduced into New Zealand from western Canada and the United States. It has thrived on suitable sites and has proved to be a valuable species on account of its good form and absence of malformation, low disease incidence, and high volume production of salable products. In State afforestation it forms an increasing proportion of the total planted and more extensive planting in woodlots and by private companies is expected.

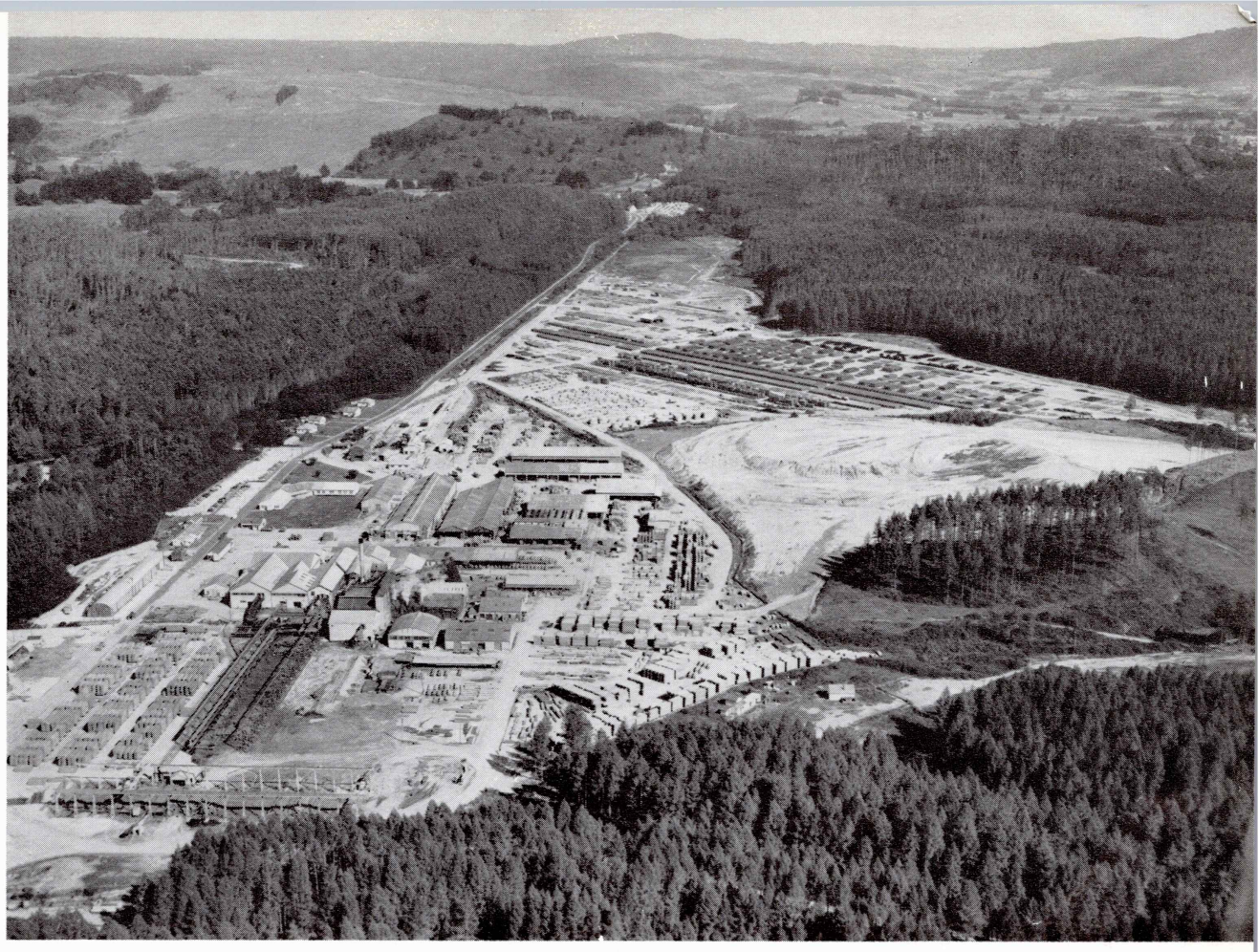
Douglas fir at Dusky Forest, Southland, New Zealand

A Skagit logger operating in the Kaingaroa State Forest

MODERN METHODS AND MACHINERY

The installation of modern equipment by State and private interests to convert the logs into sawn timber ensures efficient utilisation of the forest resources and accurately processed products in quantity.

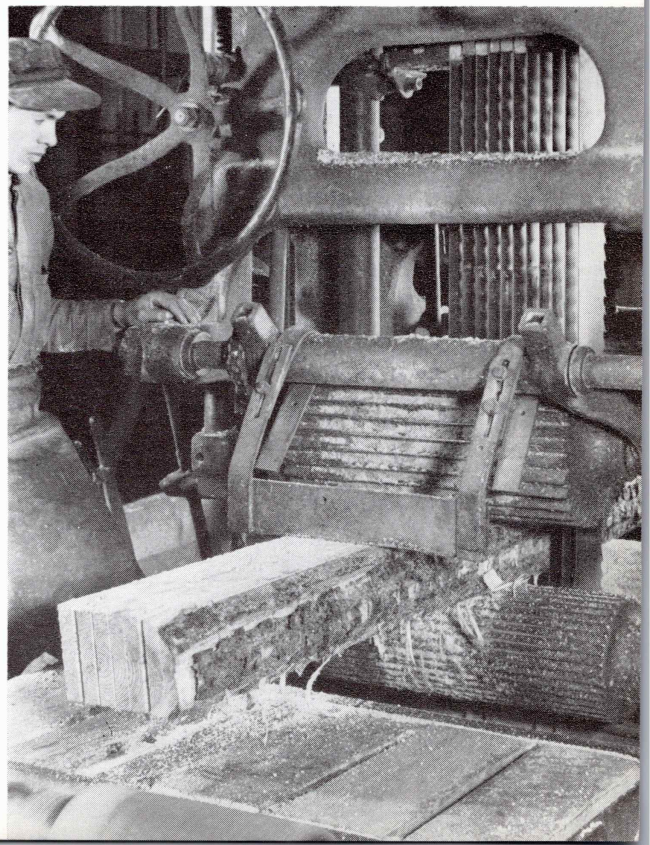
The use of air tongs for loading radiata pine logs



Waipa State sawmill, Rotorua, New Zealand

Radiata pine logs being transferred from Pacific logging trucks to railway wagons

Frame saw converts a cant into boards for selective resawing



ABOUT THE TIMBERS

Just as the botanist and the silviculturist have acclaimed radiata pine's remarkable growth rate, adaptability, and response to culture, so the timber technologist, processor, and consumer have acclaimed its properties and performance for general and special purposes.

Oregon has long been accepted as an outstanding constructional, scaffolding, ladder-stile, and plywood timber. The timber grown in New Zealand has most of the inherent qualities associated with the species in its native land.

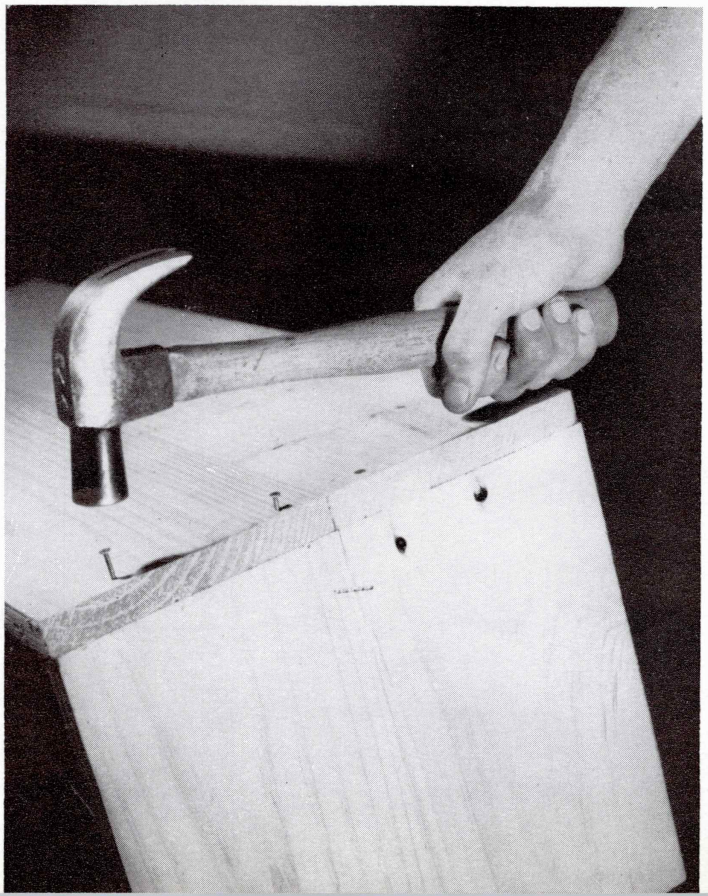
The nailing qualities of radiata pine are quite outstanding. It nails easily without splitting or splintering and holds screws firmly.

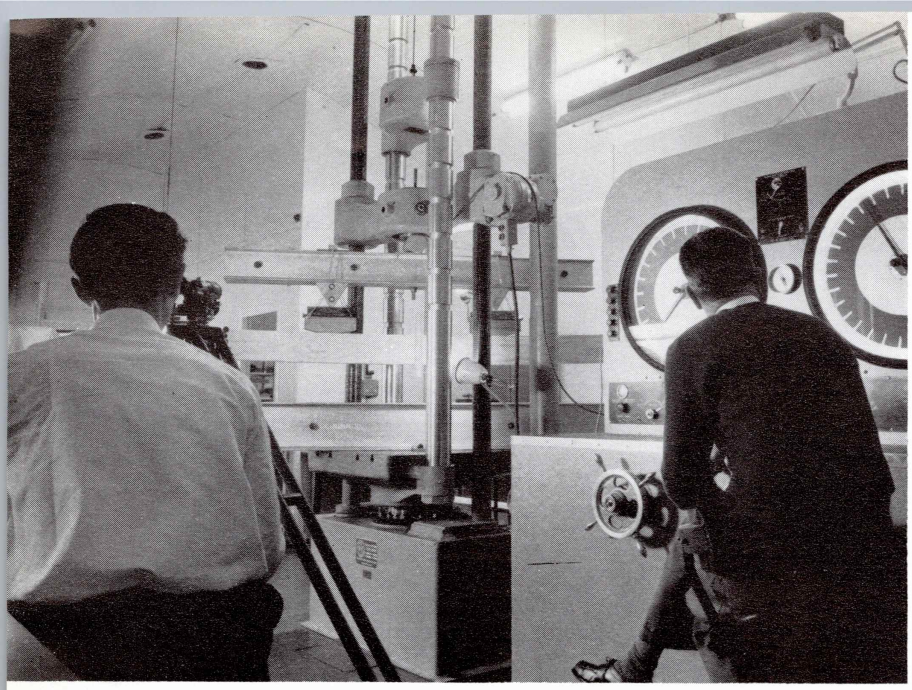
Although relatively light in weight radiata pine has a strength density relationship above normal in all major strength properties except green compressive strength parallel to the grain, and possibly toughness.

The increase in strength as the result of seasoning is exceptional.

The fine even texture of radiata pine implies ease of sawing, working with machine or hand tools, painting and other finishing

Radiata pine can be nailed close to the end of the board without the need for pre-boring and without splitting





Testing the mechanical properties of radiata pine at the Forest Research Institute, Rotorua

Large baulks of seasoned radiata pine can be handled with ease – an important consideration in building

Lustre, attractive light colour, and figure confirm radiata pine as a finishing-quality timber

SEASONING

There are a number of distinct and important advantages in seasoning any timber to the equilibrium moisture content of service conditions. It reduces the likelihood of stain, mildew, or decay during transit, storage, or subsequent use; the shrinkage that accompanies seasoning is made to take place before the wood is put to use; any tendency for the timber to distort becomes apparent in seasoning and this is graded out before sale; wood increases significantly in most strength properties as it dries below fibre-saturation point and by the same token the strength of joints made with common fasteners such as nails and screws is greater in seasoned wood than in green wood.

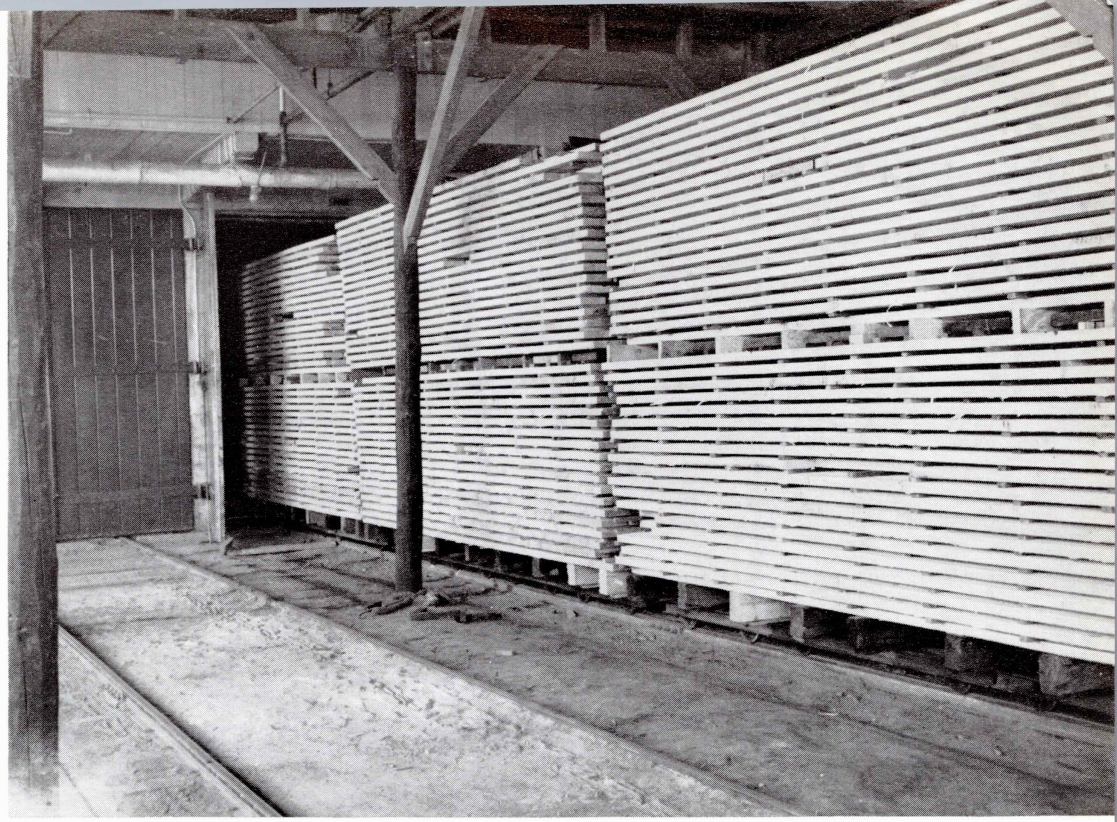
As with all timber, opinions differ on the merits of air seasoning and kiln drying; some prefer one, some the other. Radiata pine, which is light in colour, takes on an enhanced brightness and lustre if kiln dried soon after sawing. This is important for panelling, furniture, and decorative work.

Whilst the mild climate of many parts of New Zealand permits satisfactory use to be made of unseasoned radiata pine framing, in severe climates such as are to be found in Australia radiata pine scantling is fully seasoned before use.

As a guiding principle, the use of unseasoned radiata pine should be avoided. The timber should be seasoned as rapidly as possible after it is sawn; the seasoned product should be carefully stored under cover and protected from the weather whilst awaiting use.

Since Douglas fir is predominantly heartwood of relatively low moisture content the need for seasoning structural timber is not as great as it is with radiata pine.

Where a light-coloured timber such as radiata pine is not seasoned before use it should not be left block stacked, as it is apt to stain; the degree of stain depends upon how long the timber is left close stacked and upon the humidity. Under conditions favourable for their growth, stain-producing fungi can seriously disfigure radiata pine and prolongation of such conditions may permit decay organisms to become established. In order to prevent or minimise the risk of stain occurring during transit from the supplier to the user it is standard practice amongst New Zealand sawmillers to dip all radiata pine in an anti-sapstain chemical immediately after sawing. It is, nevertheless, important that the timber be taken from its export packs or bundles and filleted for seasoning as soon as possible after arrival at its destination, as the effective life of the anti-sapstain chemical is limited.



Good stacking, controlled seasoning, and protection of the seasoned timber ensure good-quality radiata pine building and manufacturing material

DURABILITY AND PRESERVATION

Provided that timber is kept dry – that is, at a moisture content below 22 per cent – decay will not occur. This established truth applies as well to radiata pine and Douglas fir as to any other timber. However, as radiata pine is produced from trees which have little heartwood, its use untreated is generally limited to purposes where sapwood or non-heart timber is suitable.

Douglas fir is only moderately durable in the ground. In ground contact, and as subfloor building timber, unless it is 100 per cent heartwood, it should be preservative treated.

The sapwood of both timbers is subject to attack by the common house borer (*Anobium*), but no more so than other commonly used softwood timbers. There are other insects which are a minor hazard to radiata pine, but kiln-drying is the best insurance against their continued working in timber going into buildings.

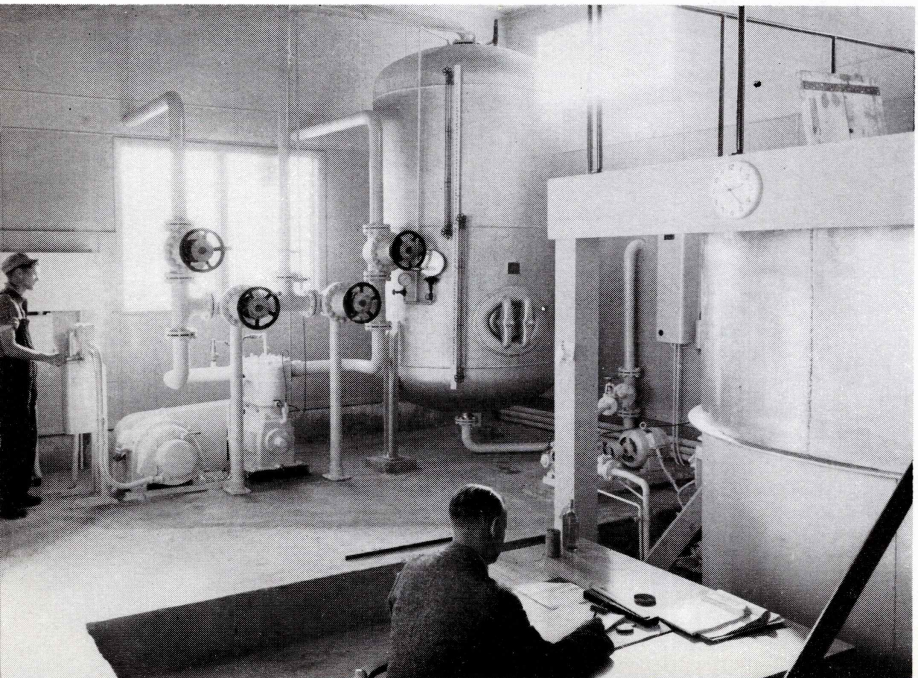
Radiata pine is exceptionally easy to treat with preservatives, and framing, for instance, is being treated in New Zealand primarily to counter attack by insect borers rather than decay.

With the use of preservative agents at relatively low cost both these timbers can be made very durable and used with complete confidence where high incidence of decay or a termite concentration would demand the use of timber with a high durability and termite-resistant rating.

It should be stressed, however, that it is both uneconomical and unnecessary to insist upon treatment to over-protect timber against the minor risks of timber deterioration which exist in well designed, well constructed, and reasonably maintained buildings.

The "three R's" of preservation treatment can be summarised as: the right material, in the right place, and in the right quantity. Deciding what is "right" in each case is the field of the preservative expert.

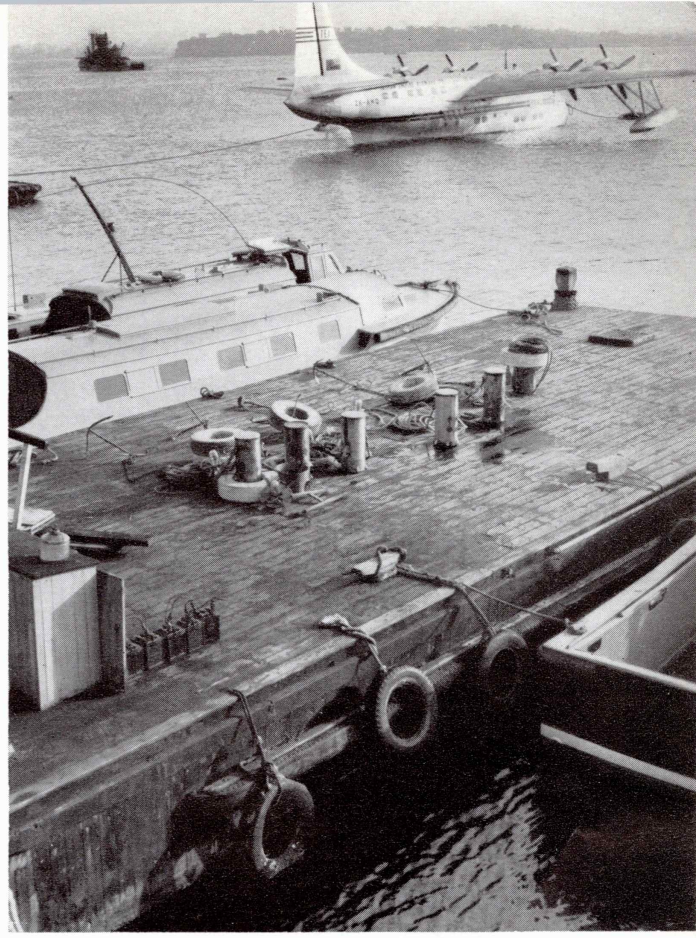
In respect to building, the architect wants to assure himself that he is selecting the right material for his particular requirement and the builder will want to ensure that he is using it in the right way.



Control room of a preservative treating plant

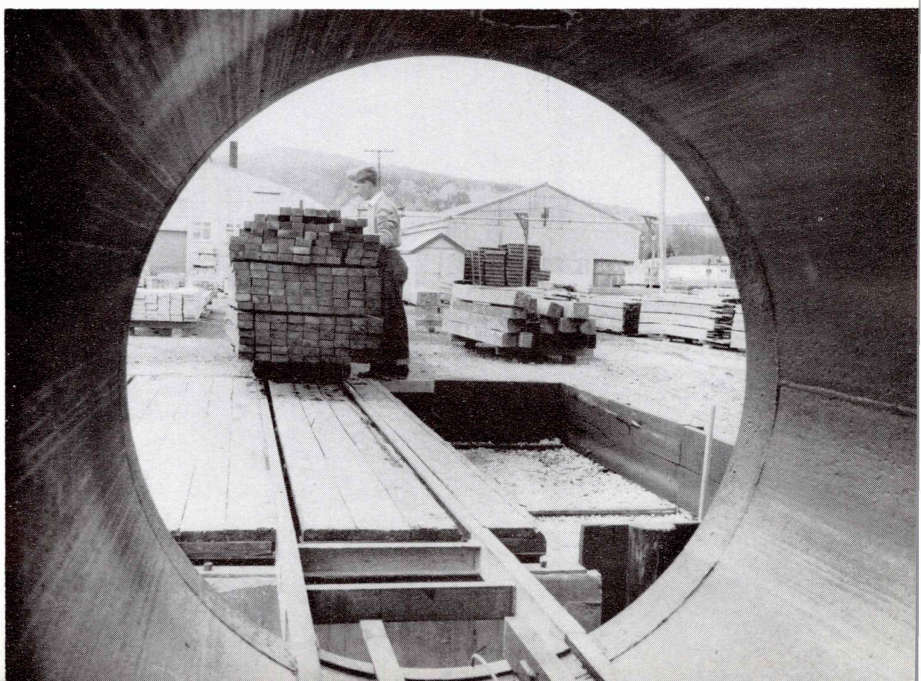
Selection of preservatives, methods of treatment, retentions, and penetrations are highly technical matters which require careful control. The demands of the situation have been met in New Zealand by the establishment of the Timber Preservation Authority, whose principal function is to secure and maintain a high standard of timber preservation. To ensure that the specified requirements are met the authority maintains an inspection service.

There are two main processes for treatment – pressure and diffusion – and the preservatives can be subdivided into oil type (creosote and pentachlorophenol), multi-salt type (boliden, celcure or tanalith), and uni-salt type (boron). A table at the back of this paper sets out the various preservatives, processes, and products currently used in New Zealand.



Creosoted radiata pine used for the construction of a commercial flying boat pontoon has given many years service without sign of marine borer attack or decay

Parcel of timber removed from a pressure treating cylinder



GRADING

In order to obtain the best results from radiata pine it is essential to use it in its correct condition and appropriate grade. Most of the sawn timber is obtained from trees containing very little heartwood. Therefore the grades do not distinguish heart and sap.

Present grading rules are designed to provide both the local and export markets with manufacturing, dressing, construction, and box-making timber. Radiata pine grading rules applicable to the New Zealand market are detailed in the New Zealand Standard Specification No. 169, February 1956. Most Douglas fir logs cut today are thinnings which do not permit the cutting of large and long-length structural sizes or a diversity of building sizes and grades. Also the well dispersed small tight knots have so far made it unnecessary to formulate framing rules.

The following is a brief outline of the present radiata pine export grades which are an adaptation of the domestic rules:

Factory grade (orange brand) is a recutting grade suitable for production of clear cuttings for the manufacture of furniture and joinery. It is specified that every board on crosscutting will yield a specified lineal footage of clear cuttings of a certain minimum length.

No. 1 grade (green brand) is intended to provide the building industry with boards suitable for use as flooring, weatherboards, shelving, panelling, linings, and interior joinery. This grade allows sound tight knots of a limited size with a few other minor defects. The basic requirement is that the timber shall be usable in the full length in which it is delivered.

No. 2 grade (purple brand) is intended for the production of dressed timber where the use does not require as high a grade as No. 1 and where appearance is not of primary importance. It is both suitable and economic for coreboard manufacture, interior framing of hollow flush doors, kitchen cupboards, upholstered furniture, and roof sarking.

Merchantable grade (blue brand) is a board grade containing No. 2 grade and better.

Construction grade (black brand) is a first-grade scantling for use in light building construction. Defects are strictly limited in size according to their effect on strength and distortion, and, as a general requirement, at least one-half the cross section of pieces up to 6 in. wide and two-thirds of the cross section of wider pieces must be free of defects.

The grading rules for this grade comply with the Australian Standard Specification for "Sawn Radiata Pine for Use as Light Framing Material".

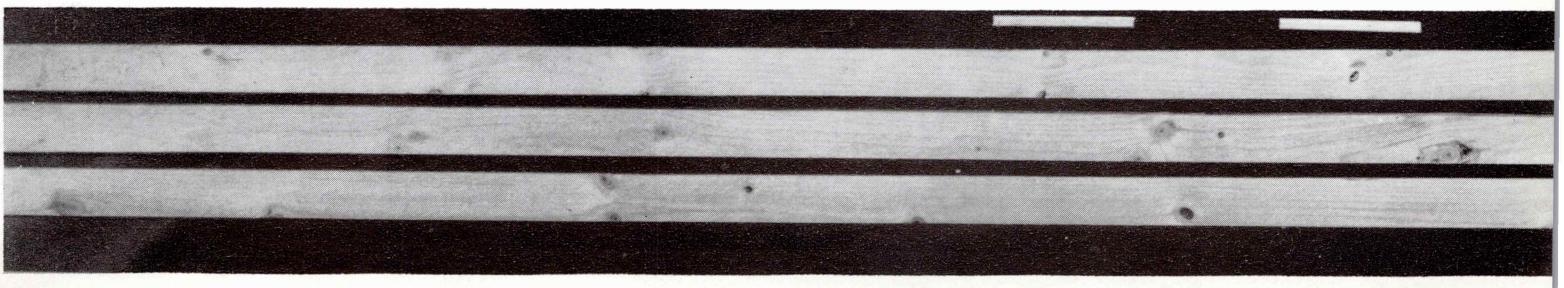
No. 3 grade (red brand) is intended principally for packaging but is also very satisfactory for temporary structural uses such as concrete shutters and form work. This grade contains the general run of defects occurring in forest-grown radiata pine. Whilst there is no specification for this grade, in practice the timber must hold together under normal handling conditions.

To ensure that a uniformly high standard of grading is adopted and maintained, regular grading courses are conducted by the New Zealand Forest Service

No. 1 Grade

Factory Grade

Construction Grade



PROCESSES TO IMPROVE GRADE AND REDUCE WASTE

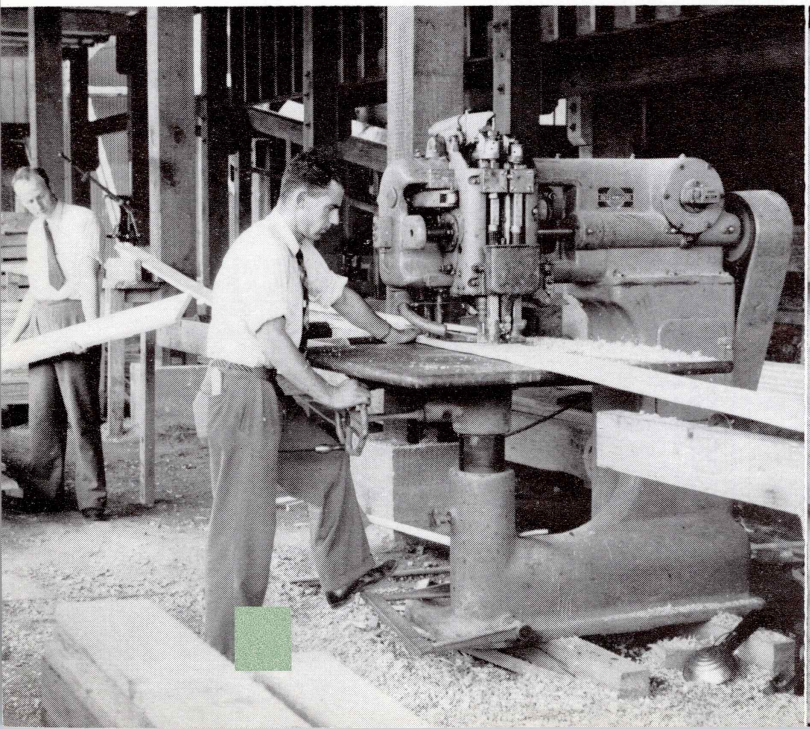
In older countries several techniques are being used to reduce the effect and incidence of defects and to improve recovery of sawn timber. Three such processes which are currently being employed in New Zealand are knot plugging, finger jointing and edge bonding.

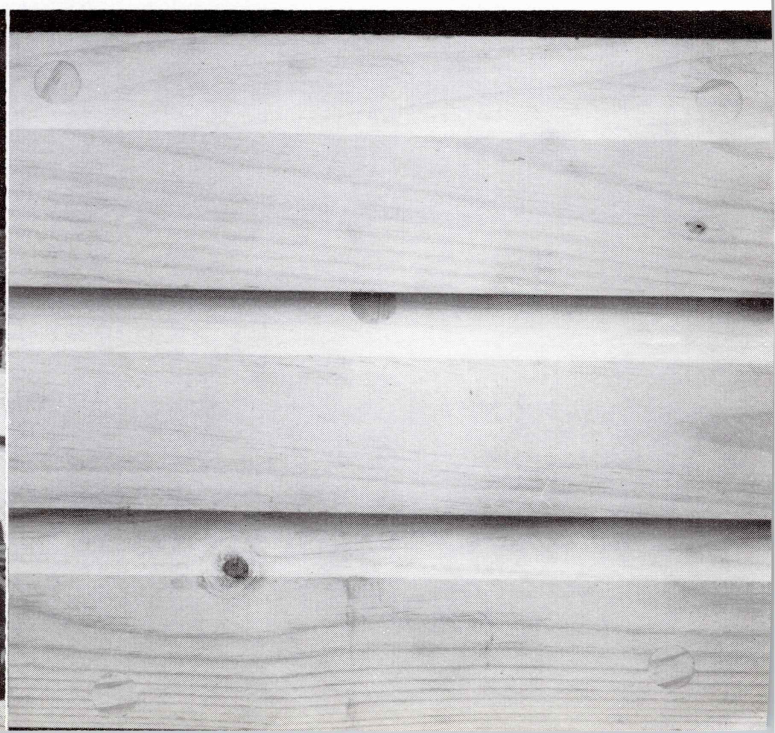
A number of sawmillers have installed knot-plugging machines to improve the grade of boards containing bark-encased knots and cone-stem holes. The machine bores the timber and inserts a tight-fitting glued plug varying from $\frac{1}{2}$ in. to $1\frac{3}{8}$ in. in diameter. The plugs can be made any thickness desired, but for boards of a nominal 1 in. thickness it is customary to use plugs $\frac{3}{8}$ in. to $\frac{5}{8}$ in. thick. The aim in plugging is to provide one good face, and it is of course necessary that this be the face which is dressed or exposed in use. The New Zealand standard grading rules for radiata pine permit plugs as no defect in all grades except finishing grade.

Finger jointing is undertaken to produce long-length products from short lengths of timber. These products can be produced from timber free from defects by cross cutting to eliminate the defects then end jointing the short clear lengths. In its rough-sawn state the product is similar in all respects to rough-sawn timber. However, when dressed to produce architraves or flooring, or resawn and dressed to produce mouldings, the final product is attractive and has been readily accepted by the New Zealand consumer.

Edge bonding is the jointing or gluing of boards of a nominal width of 3 in. and wider to produce any widths required up to 4 ft. The stock for edge bonding, which may be unjointed or finger jointed is fed, after application of glue to the edges, into a machine which applies and maintains pressure during the short period required for curing the glue bonds by radio-frequency heating. The product is available for sale in its full width as manufactured, or it can be resawn to customer requirements.

Knot boring and plugging machine and plugged radiata pine boards





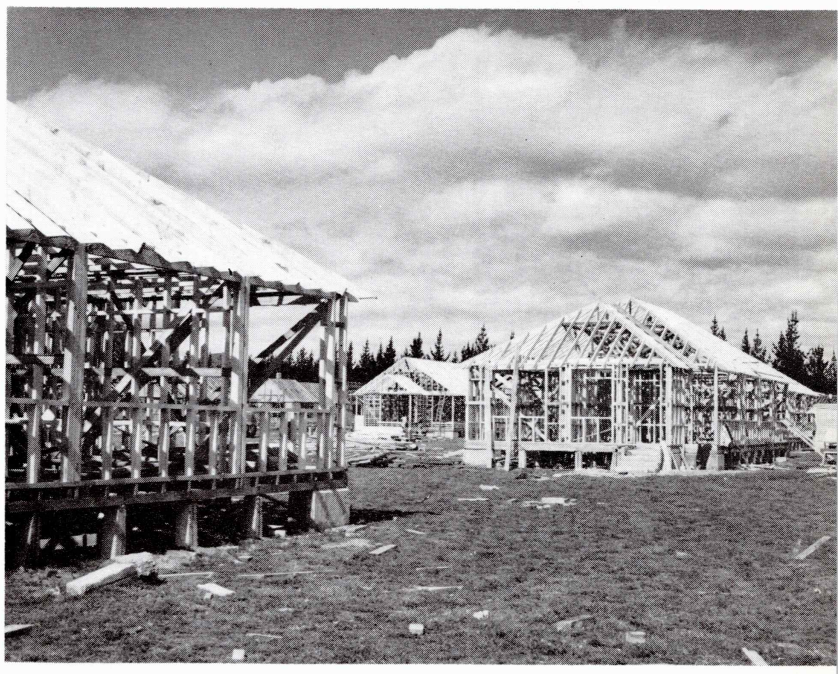
Radiata Pine

for construction and general utility.

Douglas Fir

for constructional purposes.

The illustrations on the following pages demonstrate some of the uses of both timbers in New Zealand and Australia. There is probably no other timber which has proved more adaptable or used so successfully for so many purposes as radiata pine.



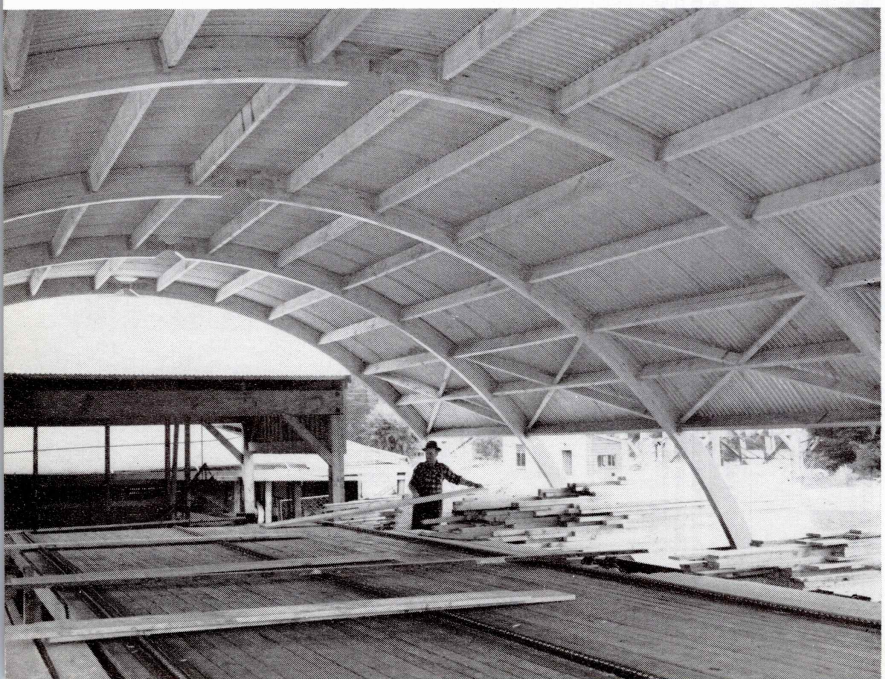
Group of houses framed throughout in radiata pine

Radiata pine in heavy construction

FRAMING

The suitability and serviceability of radiata pine for framing has been proved in New Zealand and Australia. Its ease of handling, sawing, and nailing and its high strength–weight ratio make it an admirable timber for this purpose.

Douglas fir likewise possesses excellent construction qualities.



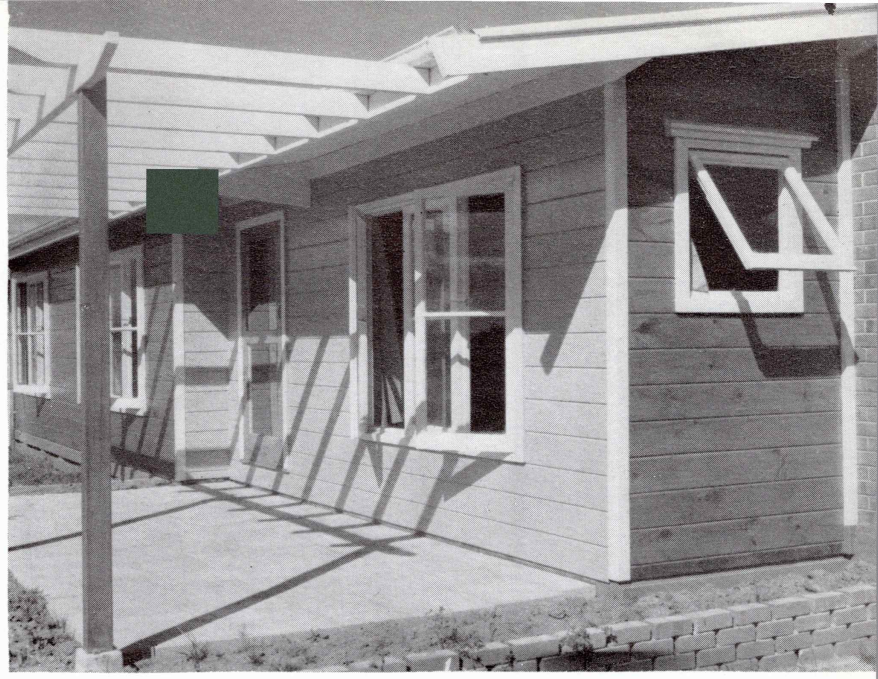
LAMINATION

Glue-laminated beams and arches and nailed or bolted trusses are playing a big part in New Zealand's constructional industry and are destined to play an increasingly important role in the future.

Radiata pine laminated structural elements possess the properties of solid single pieces and the additional qualities of light weight and high strength in long lengths, which cannot always be met in sawn timber. Where glue-laminated timbers are left exposed and clear varnished, the attractive grain enhances the beauty of the structure.

WEATHERBOARDS

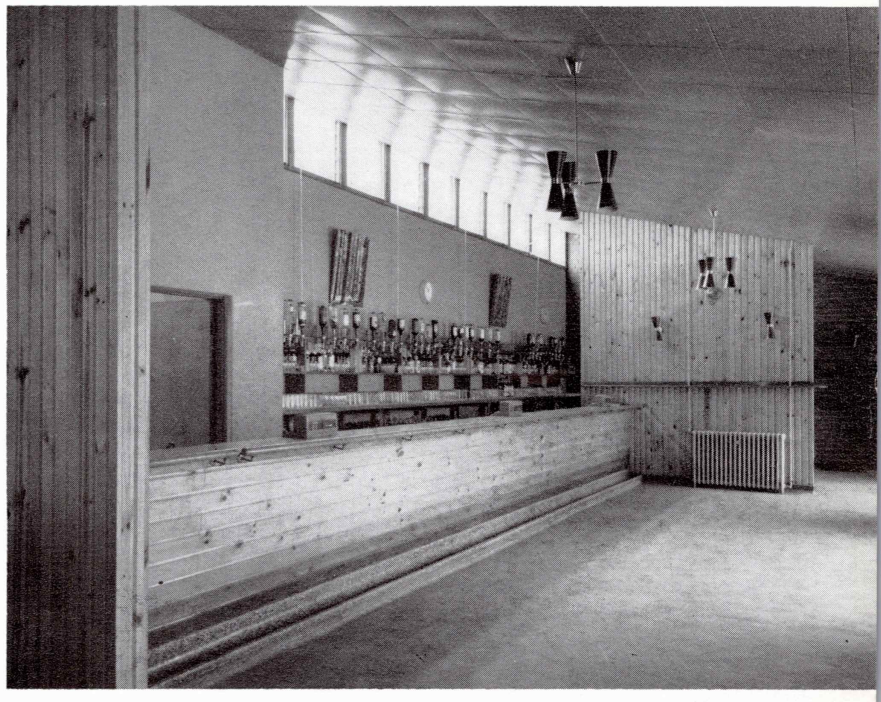
The properties of a timber suitable for weatherboards are: good seasoning, machining, and nailing qualities; freedom from warp and from defects which are not waterproof; ability to take and hold paints; and moderate durability. Radiata pine possesses all these qualities and provided sound building and painting practices are observed to prevent the entry of moisture, it gives lasting service.



FLOORING

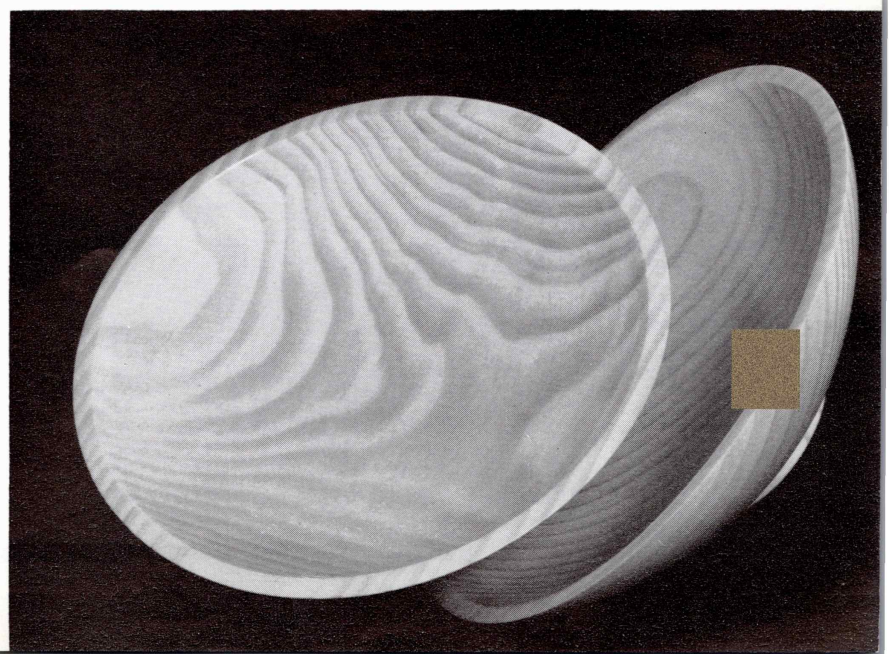
Experience in New Zealand and Australia shows that radiata pine is acceptable for flooring. Timbers inferior to it in hardness and other strength properties are widely used overseas. For more than 20 years South Australia has used radiata pine for flooring and today it is the principal domestic flooring in that State.

Where Douglas fir is used for flooring, edge-grain material is recommended.



PANELLING AND DECORATIVE WORK

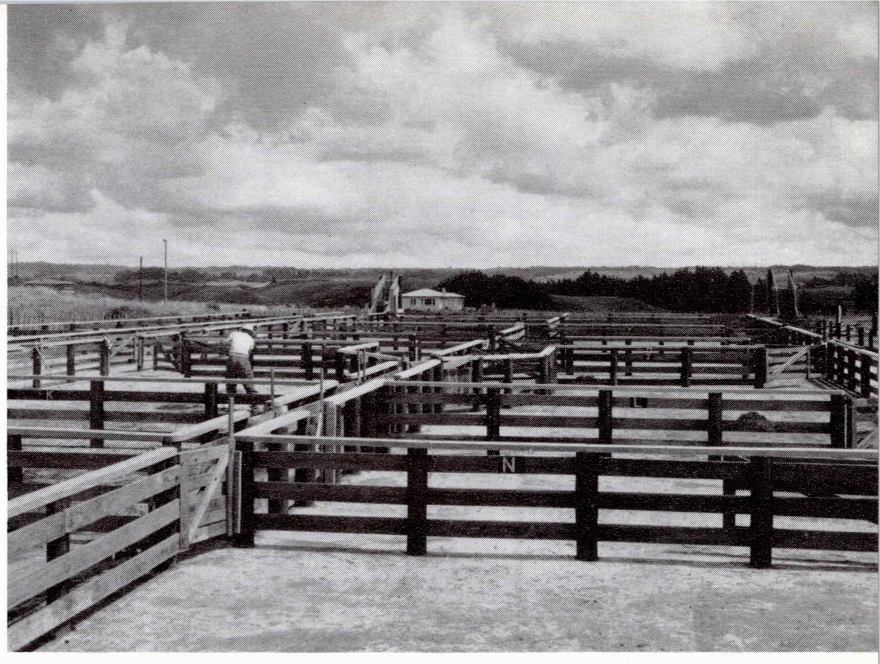
The light golden lustre of the wood in contrast with the light-brown to red-brown knots make radiata pine an interesting timber for natural-finish panelling and decorative work.



FURNITURE AND FITTINGS

Attractive grain and light appearance (which can be perpetuated with natural finishes), together with easy-working qualities have popularised the use of radiata pine in contemporary and utility-type furniture.

It is widely used for the carcass or framework of cupboard fittings, for upholstered furniture and hollow-framed flush doors, for shelving, and for coreboard manufacture.



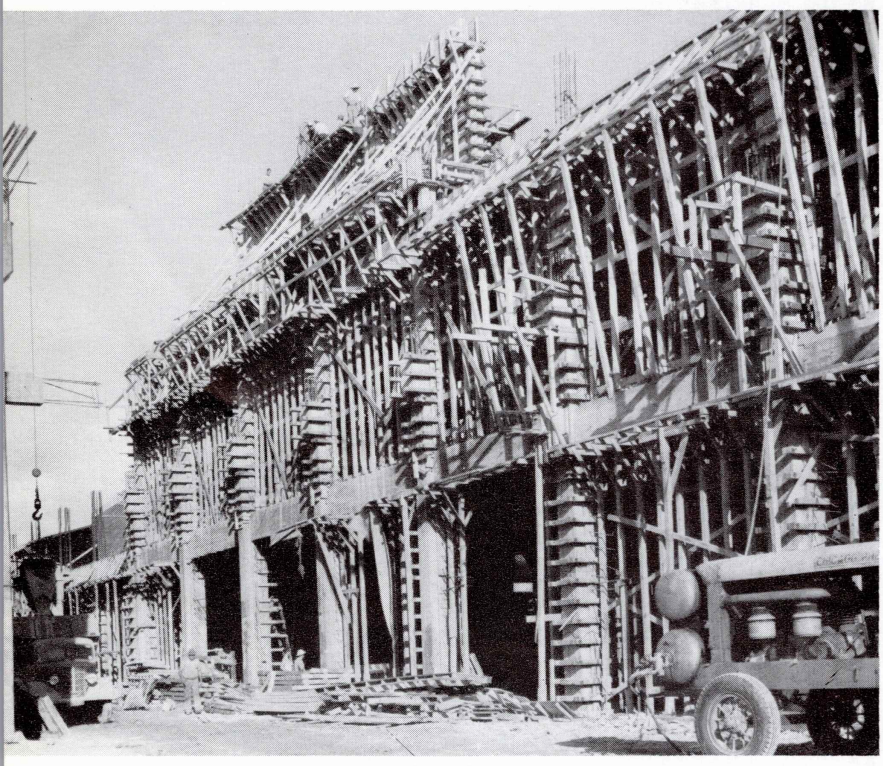
POLES AND FENCES

Timbers with a high natural durability in ground contact are becoming increasingly scarce. However, at a moderate cost non-durable timber can be impregnated with preservatives which will give it a service life at least equal to that of the most naturally durable timber.

Preservative-treated Douglas fir and larch (which has similar characteristics to Douglas fir) are being used for poles, posts, gates, rails, and pit props. Treated radiata pine is also being used for poles, fencing material, slats for cooling towers, bridge decking, highway guard rails, railway signals trunking, reservoirs, and many other such uses.

SLEEPERS

Long-term tests in both New Zealand and Australia prove conclusively that a satisfactory service life of 25 years and more can be confidently expected from preservative-treated radiata pine railway sleepers.



FORMWORK

Most of the requirements for good-quality packaging timber are also required for concrete boxing, shutters, and intricate formwork. Radiata pine is used extensively for these purposes in the construction of commercial buildings, hydro-electric power stations, etc.

PACKAGING

Whether timber is used for heavy-duty cases, fruit crates, boxes, or cable drums the requirements of light weight combined with strength, good nailing qualities, light colour, and clean appearance are the same. These qualities have made seasoned radiata pine the most keenly sought-after material for such purposes in New Zealand and Australia.

MARKETING

A very high standard of processing, grading, and presentation of exotic softwoods has been perfected and is universally practised for both the local and export markets by New Zealand sawmillers.

Timbers are graded for their intended use and are branded appropriately. All export timber is square-end docked, bound with wire into bundles (according to grade and dimension) of convenient sizes for handling with ship's gear, straddle trucks, and fork-lift trucks. Bundles are also adequately marked for identification.

The Radiata Pine Division of the Dominion Sawmillers' Federation Inc., whose function is to preserve orderly marketing, maintain high standards of merchandising, and promote the correct handling and use of exotic softwoods, represents the great majority of sawmillers engaged in the production and marketing of radiata pine in New Zealand and abroad, and has the full support of the Government in attaining these objectives.

Before export is permitted the timber is examined by Government inspectors to ensure that it is free from decay, insect infestation, and bark. Construction-grade radiata pine for the Australian market must qualify as fully seasoned timber.

PRESERVATIVE TREATMENTS

Preservative	*Process*	*Products*
Coal-tar creosote Pentachlorophenol	Hot and cold bath	Natural round timbers including sawn and split posts, part rounds for ground-contact use
Coal-tar creosote Pentachlorophenol	Vacuum – pressure	Natural round timbers including sawn and split posts, part rounds for ground-contact use
Boliden S25, K33 Celcure A Tanalith C, CA, U* Boron*	Vacuum – pressure	Same as above plus sawn building timbers
Boron compounds	Diffusion by: Momentary immersion Steam – cold quench Hot soak	Sawn building timbers for use in positions out of contact with the ground and protected from weather

*Tanalith U and boron are not suitable for ground contact and similar exterior uses.

SOME STRENGTH AND RELATED PROPERTIES

(From Tests on Small Clear Specimens)

Timbers		*Radiata Pine (Rotorua)*	*Larch (Rotorua)*	*Douglas Fir (Rotorua)*	*Douglas Fir Canada (Coast type; virgin)*	*Douglas Fir U.S.A. (Coast type; virgin)*
Density (lb/cu. ft.)	G	58	47	50	39	38
	D	28	35	34	35	34
Modulus of rupture in static bending (lb/sq. in.)	G	5,900	7,500	8,070	7,700	7,600
	D	11,000	13,500	14,150	13,300	11,700
Modulus of elasticity in static bending (thousand lb/sq. in.)	G	1,060	1,320	1,570	1,700	1,550
	D	1,310	1,740	1,950	2,050	1,920
Compression parallel to grain, maximum crushing (lb/sq. in.)	G	2,600	3,200	4,070	3,790	3,890
	D	5,900	7,100	7,890	7,700	7,420
Shear parallel to grain, maximum shear (lb/sq. in.)	G	870	820	880	920	930
	D	1,550	2,060	1,060	1,460	1,140
Side hardness (lb)	G	500	450	540	510	480
	D	620	970	700	735	670
Shrinkage (per cent), radial		1·5	2·0	2·8	–	2·9
tangential		3·6	4·9	4·9	–	4·4

G = Green.

D = Dry = Air dry, i.e. 12 per cent moisture content.

"Modulus of rupture" is the best index to bending strength when a beam is subject to a load applied slowly.

"Modulus of elasticity" is an index of stiffness.

"Maximum crushing strength" indicates the strength as a column.

"Maximum shear strength" is a measure of the ability of timber to resist slipping of one part upon another along the grain.

"Side hardness" is the load required to embed a 0·444 in. steel ball to half its diameter.

Shrinkage values are based on the green dimensions of the wood.

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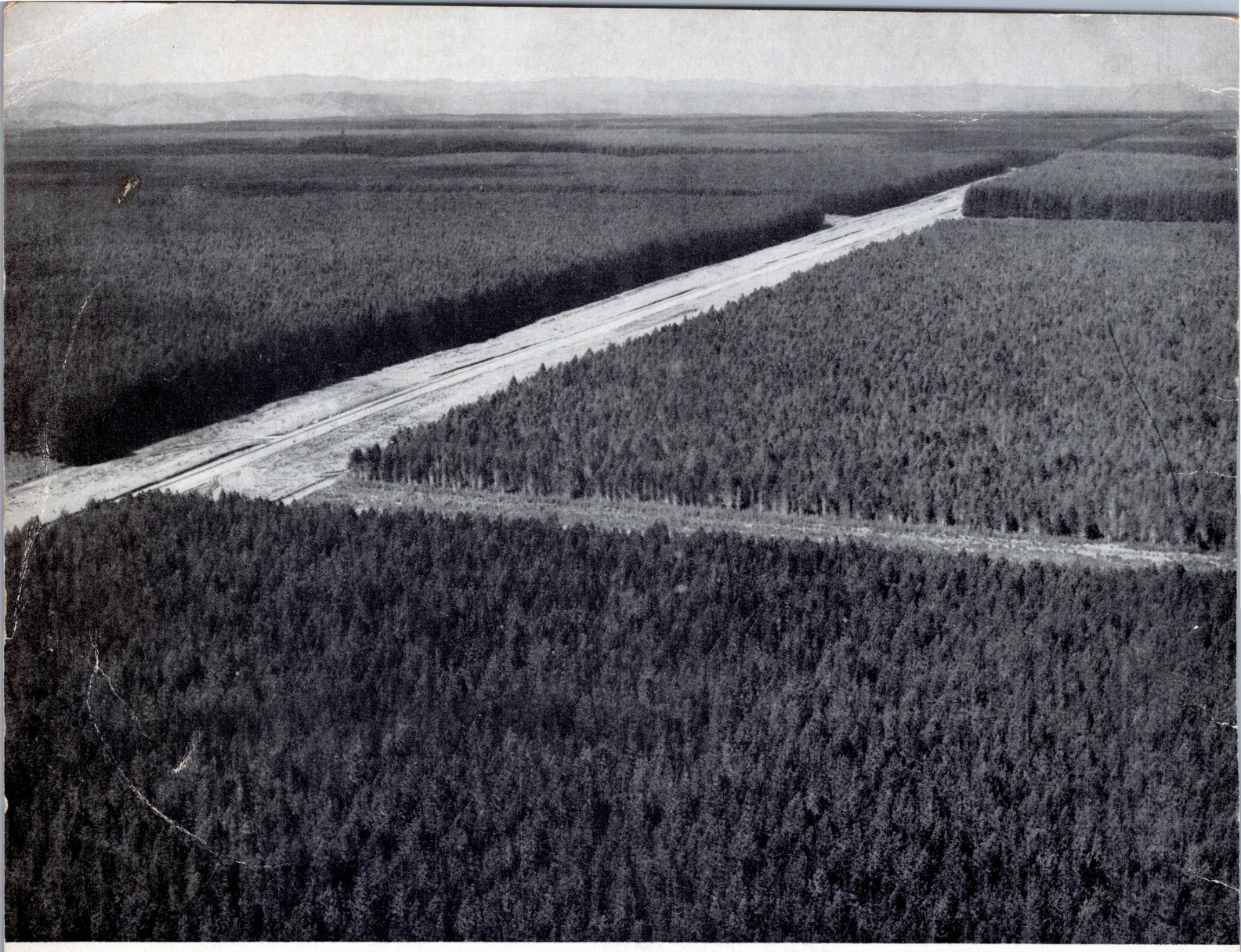
For further information refer to

N.Z. FOREST SERVICE

Wellington, New Zealand

Back cover illustration: Aerial view of part of a 250,000-acre forest of radiata pine, Douglas fir, and other coniferous species in the centre of the North Island of New Zealand. *Photo: R.N.Z.A.F.*



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